TABLE 10.—*Sky polarization, percent, sun at zenith distance 60°, Madison, Wis.*

AVERAGE OF VALUES OBSERVED DURING MONTH[1]

Year	January	February	March	April	May	June	July	August	September	October	November	December
1917	-----	-----	-----	57	54	59	59	66	66	67	59	71
1918	-----	-----	61	63	59	64	65	62	67	64	66	-----
1919	68	66	60	60	60	47	56	61	67	66	70	-----
1920	-----	-----	62	66	56	70	55	58	69	63	76	71
1921	72	65	69	60	66	64	65	57	69	68	70	72
1922	-----	-----	61	61	60	53	70	55	64	70	71	-----
1923	-----	-----	-----	58	61	52	59	66	65	64	-----	72
1924	51	-----	-----	64	58	60	60	65	68	62	65	67
1925	-----	-----	56	55	49	58	58	55	58	60	61	-----
1926	-----	-----	-----	60	53	60	49	55	70	67	-----	-----
1927	-----	-----	61	62	57	60	57	64	69	69	73	-----
1928	-----	-----	-----	67	58	66	61	67	66	69	75	-----
1929	-----	-----	73	63	54	56	62	51	59	60	65	-----
1930	-----	-----	-----	58	55	57	61	48	60	55	62	71
1931	-----	-----	66	55	53	54	60	62	61	65	72	72
1932	-----	-----	-----	60	60	62	60	59	60	58	67	-----
1933	-----	-----	-----	59	59	60	64	63	68	69	64	72
1934	-----	-----	60	56	52	65	58	47	57	52	53	-----
1935	-----	-----	-----	51	59	62	58	54	60	69	67	61
1936	-----	-----	-----	63	60	64	50	44	62	60	60	66
Mean	63.7	65.5	62.9	59.9	57.2	59.6	59.4	58.0	64.2	63.6	66.4	69.5

MAXIMUM VALUE OBSERVED DURING MONTH[1]

1917	-----	-----	-----	67	64	66	71	71	76	71	71	73
1918	-----	-----	71	67	65	69	72	71	74	69	73	-----
1919	70	68	65	66	67	57	68	71	73	71	73	-----
1920	-----	-----	67	68	67	72	69	72	75	76	79	71
1921	76	73	72	67	70	66	70	70	76	74	70	72
1922	-----	-----	61	70	66	71	72	72	74	74	72	-----
1923	-----	-----	-----	65	70	65	61	74	71	68	-----	72
1924	-----	-----	-----	69	64	71	70	71	71	66	66	67
1925	-----	-----	64	60	60	62	64	65	66	67	66	-----
1926	-----	-----	-----	-----	63	64	65	64	72	70	-----	-----
1927	-----	-----	69	65	64	65	69	70	73	76	73	-----
1928	-----	-----	-----	72	68	70	72	77	73	77	76	-----
1929	-----	-----	73	67	63	61	65	63	69	70	72	-----
1930	-----	-----	-----	70	63	69	68	59	70	61	68	71
1931	-----	-----	66	66	60	61	70	70	71	76	75	77
1932	-----	-----	-----	65	66	73	67	64	69	60	67	-----
1933	-----	-----	-----	61	70	71	72	74	77	76	65	74
1934	-----	-----	60	64	61	70	64	61	63	57	57	-----
1935	-----	-----	-----	-----	70	67	66	58	76	77	69	61
1936	-----	-----	-----	71	67	66	59	57	69	64	70	66
Mean	73.0	70.5	66.8	66.7	64.4	67.0	67.8	67.7	71.9	70.0	70.1	70.4

[1] Number of days on which observations are taken varies from month to month, and is given in reports published monthly in REVIEW.

TABLE 11.—*Comparison of blueness of sky with sky polarization and visibility, Washington, D. C.*

Blueness of sky	Percent of polarization	Visibility, miles	Number of observations
2	11.0	1.0	1
3	44.1	10.5	11
4	51.7	16.5	145
5	57.0	25.6	292
6	59.3	38.1	120
7	62.1	43.9	15
8	65.5	50.0	2

TABLE 12.—*Dust content of the atmosphere at American University, District of Columbia, at 8 a. m., particles per cubic centimeter*

MONTHLY MEANS

Year	January	February	March	April	May	June	July	August	September	October	November	December	Annual means
1922	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	1,228	-----
1923	1,061	905	540	476	393	-----	397	388	386	395	451	557	540
1924	719	533	409	645	376	420	539	326	335	598	1,110	1,159	597
1925	723	1,092	909	753	416	507	480	484	514	608	787	1,444	726
1926	1,631	1,517	1,370	755	573	578	542	532	565	692	851	1,056	888
1927	1,011	1,116	939	721	729	607	933	760	859	1,021	1,097	1,176	914
1928	1,455	1,450	1,232	856	668	596	757	675	774	1,082	979	1,227	978
1929	1,419	1,086	652	610	621	469	549	626	638	616	858	881	752
1930	898	736	668	753	614	544	573	828	866	1,020	995	875	781
1931	906	951	809	815	608	631	-----	-----	-----	-----	-----	-----	-----
Average	1,091	1,043	836	709	555	544	596	577	617	754	891	1,047	772

MAXIMA

1922	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	2,088	-----
1923	3,680	2,050	1,155	1,182	905	-----	793	794	812	853	1,023	2,340	1,394
1924	2,403	1,964	1,280	1,661	1,154	1,250	1,953	796	823	1,366	1,987	2,551	1,595
1925	1,352	2,370	2,247	7,077	781	991	1,016	1,037	1,109	1,432	1,558	3,106	2,006
1926	3,828	2,995	2,999	1,527	1,042	1,035	985	941	1,073	1,426	3,975	2,388	2,018
1927	3,511	2,474	1,877	1,588	1,529	1,560	1,651	1,443	1,672	3,133	2,566	2,984	2,168
1928	3,620	3,557	2,617	2,039	1,575	1,434	1,308	1,302	1,493	2,772	2,751	4,116	2,382
1929	3,620	1,982	1,583	1,153	1,032	897	922	976	1,010	1,098	1,628	1,606	1,463
1930	3,780	1,512	1,176	1,166	1,701	855	1,052	1,323	1,426	2,066	1,953	1,779	1,649
1931	1,617	1,649	1,352	1,434	846	1,073	-----	-----	-----	-----	-----	-----	-----
Average	3,046	2,284	1,810	2,089	1,179	1,137	1,210	1,076	1,177	1,761	2,180	2,551	1,792
Absolute maximum	3,828	3,557	2,999	7,077	1,701	1,560	1,953	1,443	1,672	3,133	3,975	4,116	-----

MINIMA

1922	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	298	-----
1923	214	105	113	113	65	-----	90	110	59	96	71	90	108
1924	124	97	76	151	124	155	124	87	97	155	113	124	118
1925	57	77	87	202	149	197	132	143	118	130	124	344	147
1926	160	298	223	227	187	214	218	145	132	82	76	145	176
1927	155	185	145	138	225	122	288	187	218	99	172	143	173
1928	160	254	162	174	126	202	384	132	126	334	120	109	190
1929	160	200	101	242	134	128	170	191	176	124	323	204	179
1930	361	253	237	241	134	178	150	144	278	384	231	376	247
1931	372	389	174	233	275	216	-----	-----	-----	-----	-----	-----	-----
Average	196	204	146	191	158	176	194	132	150	176	154	204	174
Absolute minimum	57	77	76	113	65	122	90	87	59	82	71	90	-----

FLOODS IN THE SACRAMENTO VALLEY, CALIF., DECEMBER 1937

By E. H. FLETCHER

[Weather Bureau, Sacramento, Calif., January 1938]

December 1937 will be epochal in the history of the floods of the Sacramento Valley in that it produced the highest stages in the river system above the mouth of the American River since the beginning of Weather Bureau records in 1904, and, from all indications, exceeded the high water of 1862 in the upper valley.

During the first week in October there were unprecedentedly heavy rains, for so early in the season, in the upper Sacramento River basin. A long period of protracted, heavy rainfall followed in November and resulted in the highest water of record for the season in that river.

In past years no great flood has ever been known to occur in December. This year, however, the ground was well saturated at the end of November and the stream channels and bypasses were still carrying considerable water. This condition, together with the fact that the earlier fallen snow had receded to high altitudes, constituted a favorable situation for a high percentage of immediate run-off from rainfall, there being no retarding influence occasioned by a heavy snow cover.

On December 9, a center of low barometric pressure of unusual potentialities was located about 700 miles off

the central California coast, and a forecast was issued to the effect that a general rise in all the streams of the Sacramento system was imminent. Rainfall began generally before noon of that day.

The weather map, on the next morning, showed a storm of record magnitude and almost of hurricane intensity (barometer 28.1 inches at its center) off the coast of Washington and Oregon. Maritime tropical air flowed rapidly across California at gale velocity and converged against the high mountain barriers that form the eastern and northern limits of the Sacramento basin. The moisture-laden air, with record high temperatures for December, produced torrential rains over the headwaters of the upper Sacramento, Feather, and Yuba Rivers, and to a slightly lesser extent over the American and the eastern tributaries of the San Joaquin.

Early on the 10th, warnings were issued advising of the favorable conditions for a flood, especially in Tehama County. That morning the river at Red Bluff was 11.8 feet, but by evening it had risen to 20 feet. On account of the extremely flashy nature of the streams in the upper Sacramento Valley, it is a difficult problem to forecast river stages in that section if the local creeks are discharging enormous volumes of water. The rise in the upper valley is rapid and may occur in advance of the upstream water, as indicated on the gage at Kennett.

Downieville, a town of about 400 and the county seat of Sierra County, on the North Fork of the Yuba River, suffered partial destruction on the 10th when water from a downpour of cloudburst intensity in the deep canyons above, swept through the lower part of this mountain town, carrying away a number of buildings and destroying the highway bridge at that point. Later reports indicated that the flow of water was obstructed by debris lodged against the concrete highway bridge just below the town, causing the water to back up into the streets. The damage to Downieville is estimated at $200,000, and to the surrounding area, $80,000.

The Sacramento River at Kennett crested on December 11 at 2 a. m. with a stage of 29.0 feet, which has been exceeded only in 1907 by a record stage of 33.2 feet, and in 1909 by 31.8 feet. Kennett is an outpost station in the Sacramento River Canyon where a 20-foot rise may occur overnight; and little or no damage results, except that the roadway near Big Backbone Creek becomes flooded at a stage in excess of 25 feet.

Similarly, at the outpost river station of Colgate, in a deep canyon on the North Fork of the Yuba River, the water rose with great rapidity to 22.0 feet, which is 1.0 foot above the March 1928 crest and 1.0 foot below the record high stage in 1907.

At Red Bluff, the Sacramento River, heightened by additional heavy flows from numerous important creeks from both the Coast Range and Mount Lassen area, rose rapidly to a crest of 32.0 feet on the morning of the 11th, which is 9 feet above the flood stage and 1.5 feet above the previous high record established in February 1909. Extensive inundation of the lower lands occurred as the highest flood wave of record spread southward from Red Bluff to the mouth of Stony Creek.

The towns of Gerber, Tehama, and Vina were almost completely flooded. The most serious situation occurred at Gerber when a small levee that sets back from the river and near the town gave way. About 500 persons were compelled to vacate their homes temporarily, and the damage there is estimated to be nearly $100,000.

Tehama and Vina being smaller towns, the resultant damage was proportionately less, but a number were driven from their homes, and were cared for by the Red Cross, which agency furnished prompt relief at every point where relief was needed. The flooding in the Vina section was caused by the overflow of Deer Creek near its confluence with the Sacramento.

As heavy flooding of the Gerber-Tehama section occurred near midnight of December 10, and before the main volume of the upstream crest arrived, it is evident that the several creeks with headwaters in the high mountains east and west of the Tehama County section were carrying volumes of water not previously experienced. This was substantiated by the rainfall observer at Beegum on Cottonwood Creek, 43 miles west of Red Bluff, who reported the creek there to have been 1 foot above the previous high-water mark.

A public service storage reservoir on Pine Creek, a tributary of the Pit River in Modoc County, collapsed and flooded much of the town of Alturas, causing property damage and driving many persons from their homes. On the Sacramento River, 3 miles above the mouth of Stony Creek, at Hamilton City, the highest stage was 22.8 feet, or 0.8 foot above the record high stage in 1928. Near the mouth of Stony Creek, the crest was 12.0 feet, at St. John, or 0.6 foot under the record established in 1909. When it is recalled that 8 or 9 feet is an exceptionally high stage for this station, the intensity of the rainfall over the Coast Range can be realized. Of course, the Stony Gorge Reservoir was discharging heavily, having been filled during the November rains.

The Feather River, at Oroville, reached a stage of 26.3 feet, or 1.9 feet below that in 1907, and about equal to the 1928 crest. Water seeping through the porous levee, backed up into the lower section of the city and flooded a number of houses, but at no time was the business section in danger, as the water was 3 or 4 feet below the top of the substantial levee. At Hamilton Bend, about 6 miles below Oroville, the flood water from the Feather River overtopped the west side levee and spread westward over a large area of farming and orchard land in the vicinity of Gridley and Biggs, finally reaching Butte Creek north of the Marysville Buttes. Heavy losses occurred here, as well as in Reclamation Districts No. 10 and 784 in Sutter County on the east side of the river where levees broke, inundating valuable orchard and cultivated lands. Farm houses were submerged to the second stories in the lower parts of these districts.

The peak stage at Marysville, on the Yuba River, was 25.7 feet, or 1.7 feet above the previous highest water of March 1928. A migratory labor camp of the Farm Security Administration, situated on low ground outside the levee, was submerged, and considerable damage resulted to the buildings and grounds, but all the occupants were removed when warnings were issued well in advance.

In the foothills and mountains from the American River northward to Mount Shasta, mountain torrents were unusually destructive to highways, bridges, and railroads in the way of washouts and erosion. The State Division of Highways reports that the total damage to State highway property will exceed half a million dollars; about 20 bridges were destroyed. County roads and bridges also suffered heavy damage. The three principal railroads operating in this district sustained losses aggregating over $300,000. As a result of the storm, railway service was crippled and communication wires and power lines were disrupted. The flooding of the valley floor in many sections, due to numerous breaks in levees and the overflowing of natural banks, seriously interrupted highway traffic and caused widespread damage to agricultural

lands, houses, farm property, and in a few instances, town property.

The 48 gates of the Sacramento Weir were opened about 5 p. m. on the 11th, when the gage at Sacramento was 26.9 feet. Following the opening of the gates, the river fell 0.4 foot and then remained about stationary for 2 hours when it began to rise to a crest of 27.7 feet at 2 a. m. on the 12th.

More than a dozen breaks in the east and west levees occurred in the Butte City-Colusa Weir section, relieving the situation somewhat from Colusa southward. Water pouring through 10 breaks, of increasing width on the west side, caused flooding of large acreage of agricultural lands in Glenn and Colusa counties. Only slight damage occurred from the overflow through the east side levee as the water passed quickly into the Butte Bypass.

The rise at Colusa was considerably checked when widening levee breaks developed above the station. A crest of 26.8 feet occurred prematurely, because the excess flood waters were freely escaping on both sides of the river upstream. However, a slight secondary rise was noted the following day as the accumulation of water in Butte Bypass flowing from the breaks above prevented *the full functioning of Colusa and Moulton Weirs.*

At Nicolaus, on the lower Feather, a new all-time high stage of 24.6 feet was recorded, 1.4 feet above the previous high in 1928. The Sacramento River at Knights Landing rose steadily from the combined influence of the Feather and the up-Sacramento water, and reached a record high stage of 38.5 feet at Fremont Weir on the 14th, representing a 5-foot overflow along this 2-mile-wide outlet into Yolo Bypass.

Although a 32-foot stage had been forecast for Knights Landing about 2 days in advance, warnings of an extremely dangerous situation were repeated and emphasized as the water rose perilously near the tops of the levees, which were hastily reinforced with bags of sand. A crest of 32.6 feet at Knights Landing on the 14th, established a new absolute high record, 2.6 feet above the flood stage, 0.4 foot above the previous high in 1907, and 1.4 feet above that of March 1928.

In the Yolo Bypass the substandard leveed island tracts of Little Holland, Liberty, and Prospect were submerged, a total area of about 5,000 acres. Two other delta tracts, namely, Upper Hastings and Egbert, narrowly escaped inundation during the extremely high tides on the 14th and 15th. Egbert tract was saved from flooding, it was reported, by the heroic efforts of a crew of several hundred men reinforcing the levees with sand bags. The fact that there was very little wind at the critical time was an important favorable factor.

Unlike most other important floods that have occurred in the central valleys of California, the one under consideration caused no serious situation in the Sacramento-San Joaquin Delta region outside the Yolo Bypass district. This was true because the San Joaquin River was at low stages, the first run-off in its eastern tributaries having gone into the numerous storage reservoirs. The American River also was not as high by about 3 feet as it was in 1907 and 1928; and the early opening of the gates of the Sacramento Weir diverted a large volume of water into the Yolo Bypass, allowing it to escape into the widened channel of the Sacramento River north of Rio Vista. Hence, the city of Sacramento was at no time endangered.

Serious breaks in the levees in the Princeton-Butte City section, north of Colusa allowed the water to spread overland westward and southward in Glenn, Colusa, and Yolo Counties, inundating 100,000 acres of reclaimed land, and extended over an irregular area from Butte City to Knights Landing.

The storm was one of the most intense to occur in this region, considering that in only about 2½ days it produced higher water conditions equaling and exceeding storms of from 6 to 14 days' duration in past years. The bulk of the rain occurred in 48 hours, although some fell over a period of 4 days. The greatest falls occurred in the Feather-*Yuba section at elevations between 3,000 and 6,000 feet.* In the 2-day period, December 10 and 11, rainfall in excess of 18.00 inches occurred in places. The greatest 24-hour falls reported were 11.61 and 11.48 inches, at Brush Creek, on the Middle Fork of the Feather, and Scales, on the North Fork of the Yuba, respectively. Despite the brevity of the period of downpour, exceptionally high precipitation records were established, as will be seen from the accompanying tabulation.

Rainfall from Dec. 9 to 12, inclusive (inches)

Stations	Elevation	December				Total
		9	10	11	12	
Upper Sacramento	*Feet*					
Squaw Creek	1,130		4.55	5.89	1.57	12.01
Dunsmuir	2,280	T	1.95	5.06	1.62	8.63
Delta	1,138	2.44	5.48	2.08	.01	10.01
Vollmers	1,332		4.30	4.01	.70	9.01
Kennett	655		3.67	7.75	1.03	12.45
Redding	722	2.63	4.85	.66	.01	8.15
Upper Lake	1,343	.72	5.35	3.30	.60	9.97
Feather						
Volta	2,100	.36	1.60	4.05	4.06	10.07
Mineral	4,950	.57	6.88	7.25	.18	14.88
De Sabla	2,700	.75	6.66	5.99	.02	13.42
West Branch	3,216	.73	8.00	7.58	.39	16.70
Las Plumas	569	.87	7.54	4.46	.04	12.91
Quincy	3,409		3.10	5.25	.75	9.10
Brush Creek	3,500		6.35	11.61	.96	18.92
Bucks Creek	1,750	.70	6.47	6.45	.50	14.12
Bucks Storage Reservoir	5,070	.46	(1)	(1)	(1)	19.41
Challenge	2,600		6.12	4.00	6.30	16.42
Yuba-Bear						
Scales	4,300	1.01	11.48	7.37	.67	20.53
Deer Creek	3,700	.30	7.92	4.59	.90	13.71
Colgate	572	.20	2.87	2.90	.22	6.19
Nevada City	2,500		3.95	4.72	1.17	9.84
Bowman Dam	5,347	.26	7.83	5.31	.38	13.78
Spaulding	5,075	.54	8.43	5.20	.60	14.77
American						
Twin Lakes	7,920	.18	3.82	3.78	.84	8.62
Soda Springs	6,752		5.00	5.80	2.03	12.83
Blue Canyon	4,750	.58	5.27	3.28	.65	9.78
Colfax	2,421		3.92	4.62	1.40	9.94
Placerville	1,925		1.95	2.05	1.65	5.65
Forest Hill	3,109		2.14	3.58	1.31	7.03
Georgetown	2,300		3.50	3.10	1.05	7.65

[1] Daily amounts not measured.

Considerable flooding of low sections occurred in Indian Valley on the North Fork of the Feather River in Plumas County. However, little agricultural damage was done, although the homes of about 75 persons were in the affected area.

The heavy discharge of Cache Creek materially intensified the situation in the upper Yolo Basin north of Woodland, where there was overflow damage from this creek. It was also in this vicinity that the escaped water from the 10 levee breaks north of Colusa, spreading southward through the Colusa Trough section, finally reached the Yolo Bypass at Knights Landing Cut, covering, en route, many thousands of acres. Damage to prospective crops was high—grain, rice, and alfalfa lands being eroded. The top soil of some ranches was washed away and deposited on neighboring fields.

44143—38——3

Also, it was characteristic in the flood for most of the larger creeks entering the valley laterally to overflow their banks and spread debris and destruction over the adjacent lands. This was notably true of the creeks in Butte, Tehama, and Shasta Counties, the more important ones being Butte, Chico, Deer, Mill, Antelope, and Battle Creeks on the east side, and Cottonwood, Thomas, Stony, Cache, and Putah Creeks on the west side.

Many of these creeks, including those in the Feather-Yuba system developed discharges never before observed, the tremendous flood volumes carrying away bridges and other obstructions. This was exemplified by the damage at Downieville and Alturas and also by the rapid development of flood conditions in Tehama and Butte Counties.

Damage of serious proportions practically halted all surface, dredge, and placer mining throughout northern California in the wake of the destructive stream flow. Dredging operations were hit hardest when flood waters covered machinery, or swept equipment downstream, in almost every tributary of the Sacramento River system. Placer mining areas, notably in Sierra County around Downieville and throughout much of the foothill country, reported widespread damage.

The outstanding characteristic of this flood was the suddenness with which all streams rose to excessive heights simultaneously. This is demonstrated in the character of the debris carried by and left in the wake of the flood on many streams. For instance, at Yuba City, articles of furniture, parts of buildings, and lumber were seen passing down the Feather River. Fowls, hogs, and other farm animals also were carried down on the crest of the flood waters.

The tabulation of losses below is the result of questionnaires returned from authentic sources of information. Judgment was exercised to exclude any overlapping estimates in reports from different officials. For the most part the items were obtained from county and state engineers, county agricultural commissioners, and river observers. Comparisons were also made with other agencies collecting similar statistics.

For the Sacramento drainage area:	
Estimated total damage of all kinds, caused by stream flow [1]	$7,127,950
Estimated value of property saved by warnings	2,226,500
Total acreage of agricultural lands flooded	706,500
Number of persons driven from their homes or places of business	1,800

[1] Not included are general storm damages, such as from wind, and earth slides and erosion in the mountains. The State of California, Public Works Department, estimates a loss of $14,635,000, covering all losses from the storm for the entire state.

These total figures are significant in comparison with the statistical data for similar items of losses in past outstanding floods. In the book *Floods in the Sacramento and San Joaquin Watersheds*, by N. R. Taylor, published in 1913, it is stated that the estimated losses due to floods in the Sacramento and San Joaquin Valleys during the floods of 1904, 1907, and 1909, aggregated $10,325,000, and that the total amount saved during the floods of 1907 and 1909, by reason of the timely warnings that were issued by the Weather Bureau, aggregated close to $2,000,000.

The total losses in the floods of January and February 1909 were $2,506,000, while the saving as the result of warnings issued was $295,000. In the floods of January and February 1911, the values were: $650,000 and $230,000, respectively, while in the March 1928 flood they were recorded as $736,500 and $200,000, under the respective classification of losses and savings.

In this connection, it must be borne in mind that in the earlier floods the statistics quoted include heavy damage in the San Joaquin Valley also, it being before many of the storage reservoirs were constructed. From all angles of analysis, it is clear that the brief flood of December 1937 in the Sacramento system above the mouth of the American River has no parallel in the flood history of this valley.

Because of the heavy run-off at the sources of the streams in high elevations, augmented somewhat by melting snow over extreme upper limits, all streams were slow to recede. The late November storms deposited about 3 feet of snow over the headwaters of the American River, but at the beginning of the December storm the snow cover above the 6,500-foot level had settled to about 12 inches. During the first day of heavy rainfall, December 10, the old snow melted completely, releasing 2 or 3 inches of additional water.

The popular belief is that devastating floods occur mainly in connection with melting snows, occasioned by heavy rains. The following notations may offer in part an explanation of the occurrence of the recent flood in absence of material snow cover in the mountains.

During a storm period, when a substantial run-off occurs from heavy rains extending to high altitudes, from 2 to 4 feet of snow may completely disappear from a 1,000-foot altitude belt just above the snow line as it was located at the beginning of the rain. This recession of the snow line releases a large volume of snow water over a limited area, but it will not be menacing if it occurs only at rather low or intermediate altitudes. The normally heavy snow cover which prevails at higher levels, under such circumstances, will absorb a great amount of rainfall and thus restrict the run-off over a large proportion of the drainage area constituting the potential flood hazard. If on the other hand, the belt of receding snow extends to comparatively high levels, the area of effective run-off is proportionately increased, due largely to the absence of the snow mantle and its dampening effect on run-off. From this it is apparent that the higher the snow line at the beginning of heavy, general rains, the greater the probability of occurrence of high water.

Several factors have an important bearing on the situation however, such as the intensity and duration of so-called warm rains and the depth and density of the snow cover from intermediate to rather high levels. While it is true that water from melting snow is an important contribution to run-off, its ultimate effect on the flood situation depends upon the width and elevation of the zone over which the snow line recedes during the course of a general rain storm, which determines the magnitude and extent of the effective run-off area.